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(54) **SEALING APPARATUS FOR VACUUM WINDOW MANUFACTURING EQUIPMENT**

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B23P 19/04 (2006.01)

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CPC ***E06B 3/6775*** (2013.01)

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(Continued)

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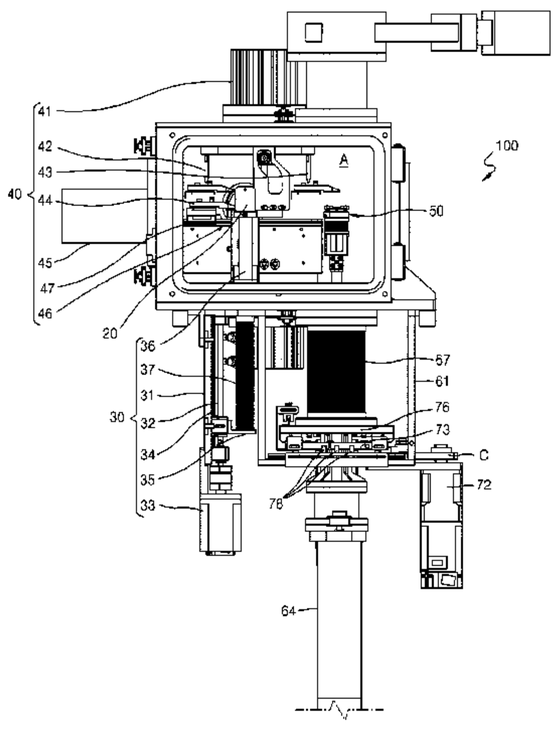
(57) **ABSTRACT**

The present invention relates to a sealing apparatus for vacuum window manufacturing equipment, the sealing apparatus being configured to cover a vacuum hole formed in at least one glass plate for a vacuum window with a cover. The sealing apparatus includes: a vacuum chamber including an internal space and configured to be evacuated for forming a vacuum therein; a cartridge installed in the internal space and accommodating a plurality of covers; a cartridge elevator installed on the vacuum chamber and configured to sequentially lift or lower the cartridge; a cover transfer device installed in the internal space and configured to transfer the covers one by one from the cartridge; a cover-rest head configured to receive a cover from the cover transfer device; and a head elevator configured to lift up the cover-rest head to the vacuum hole of the glass plate.

10 Claims, 6 Drawing Sheets



(58) **Field of Classification Search**
USPC 65/34; 156/87
See application file for complete search history.

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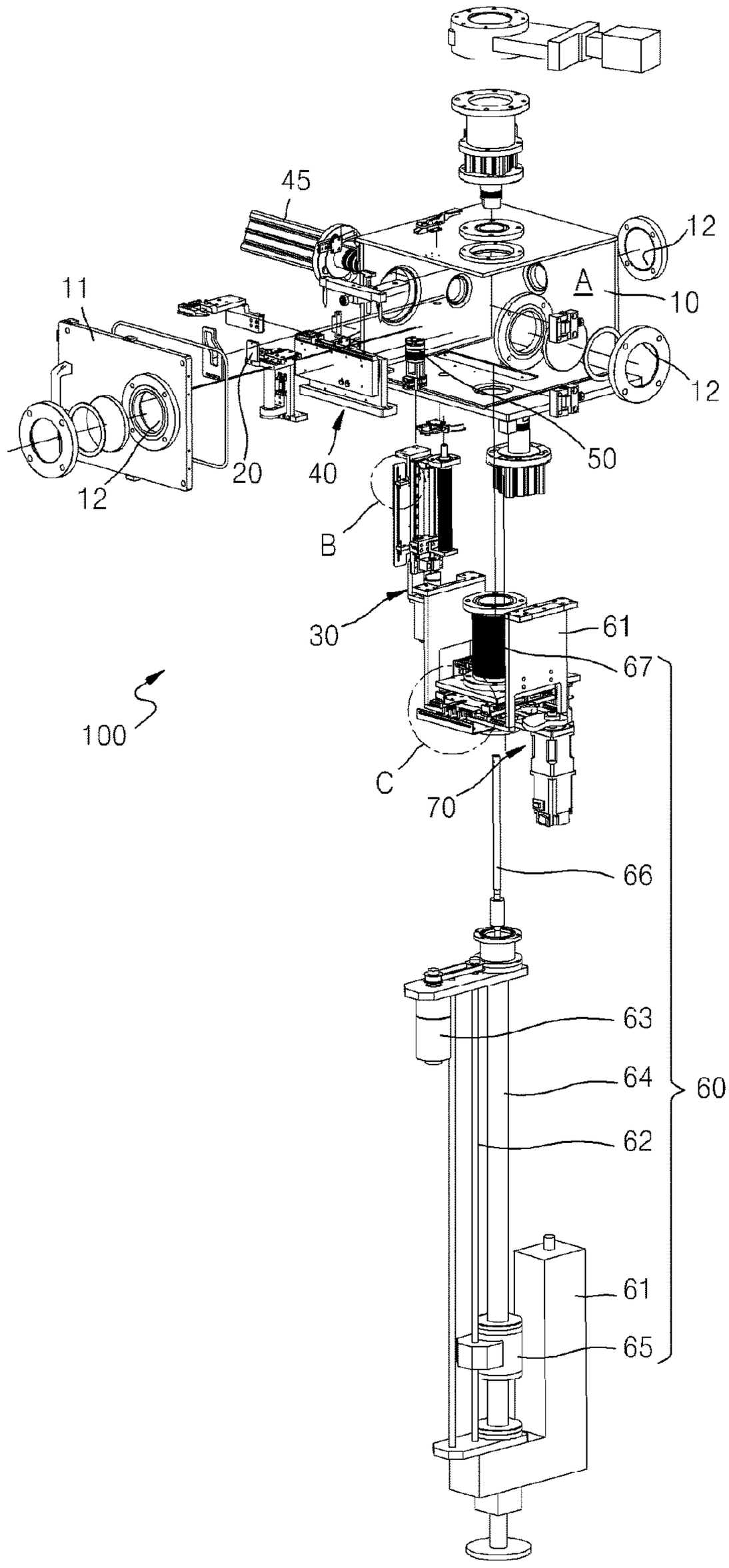
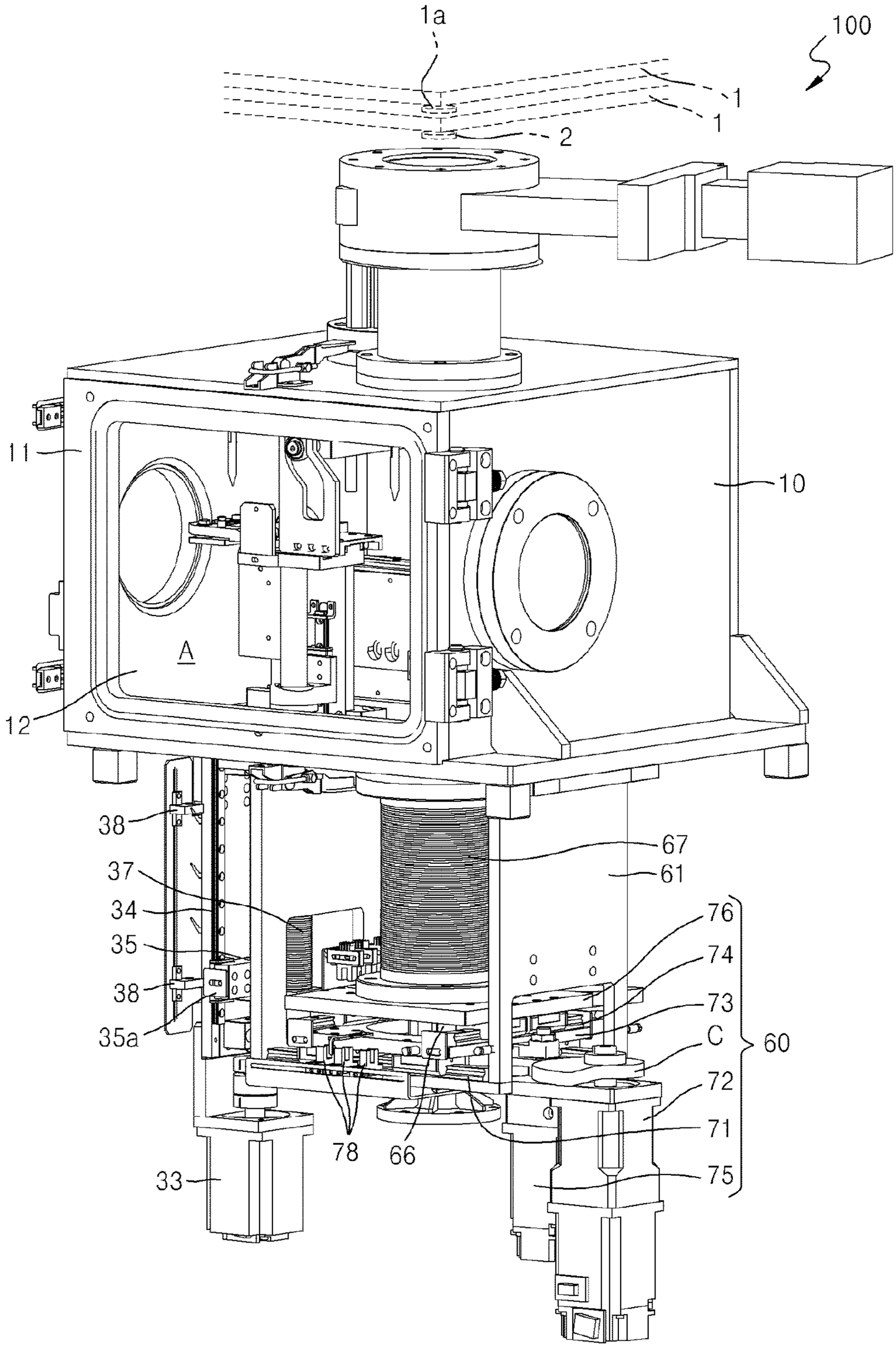
[Fig. 1]



[Fig. 2]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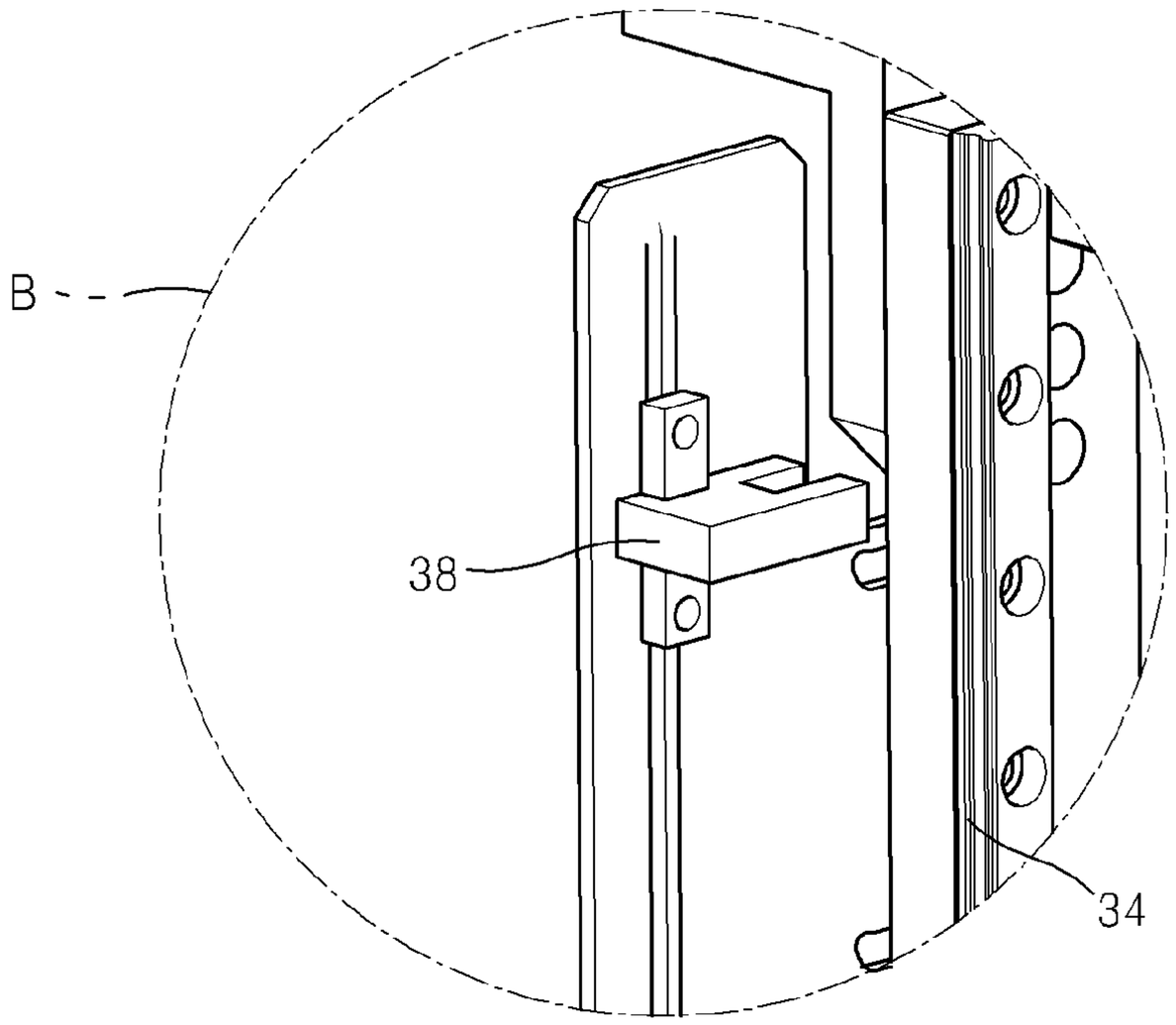
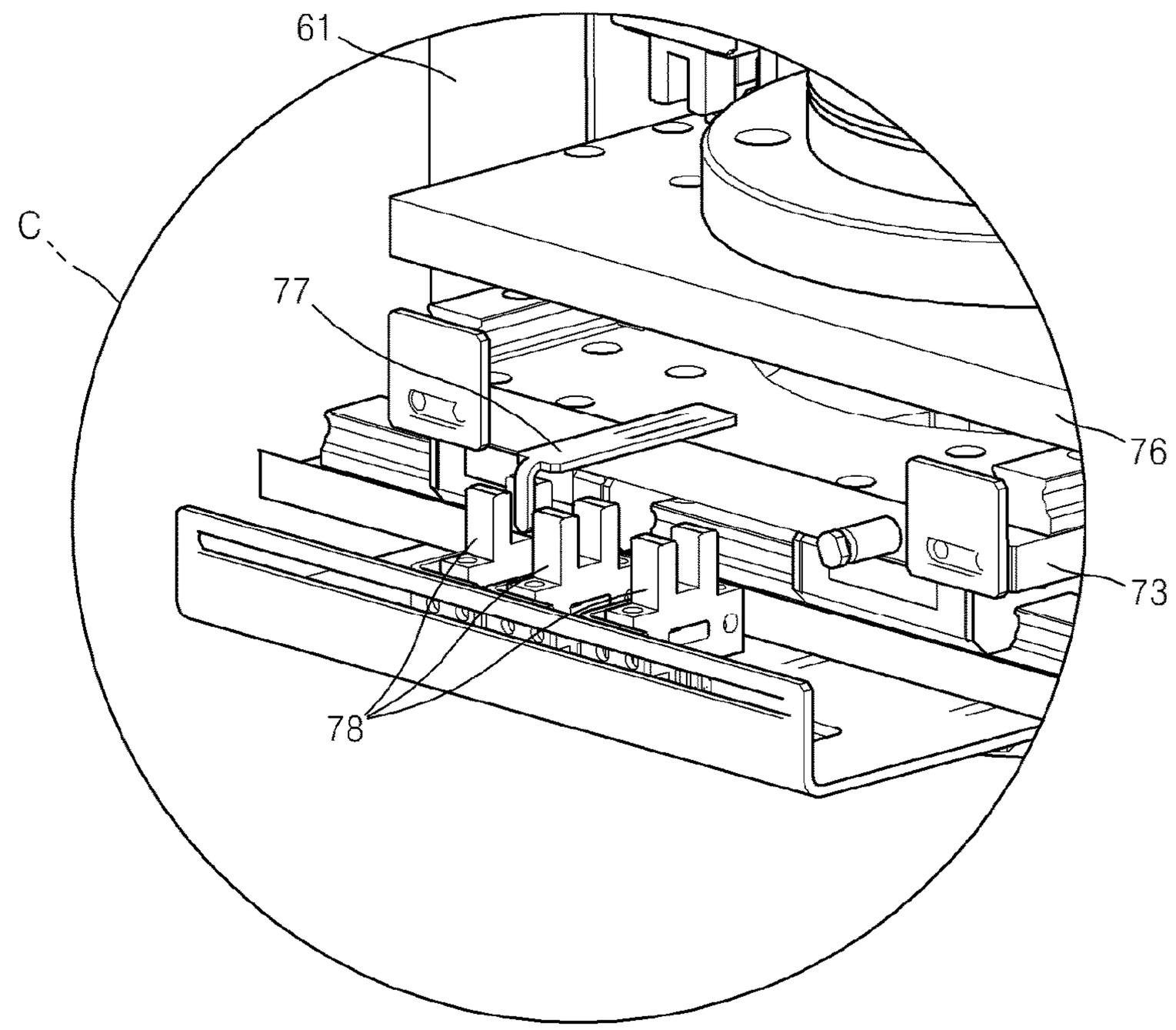
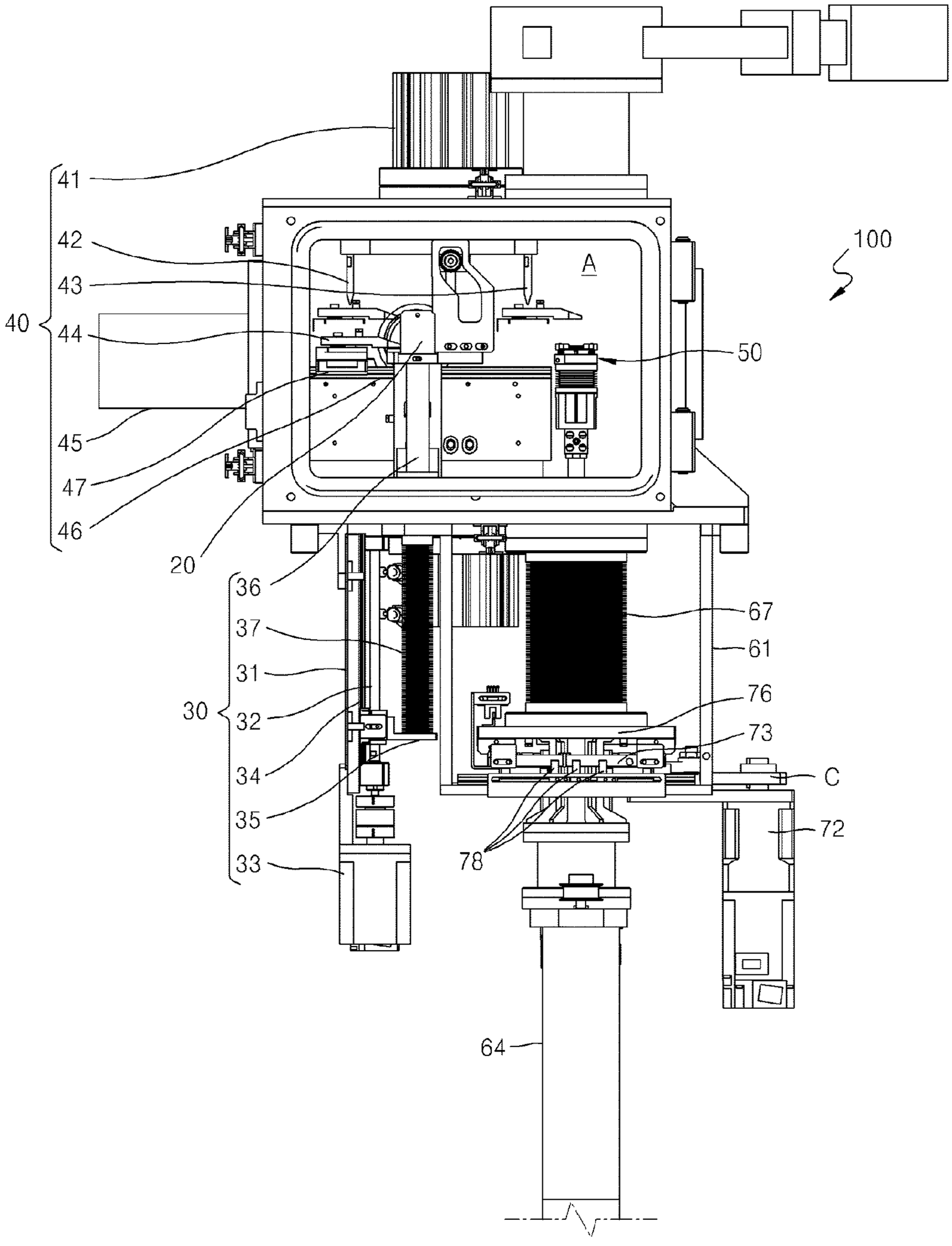
[Fig. 3]



[Fig. 4]



[Fig. 5]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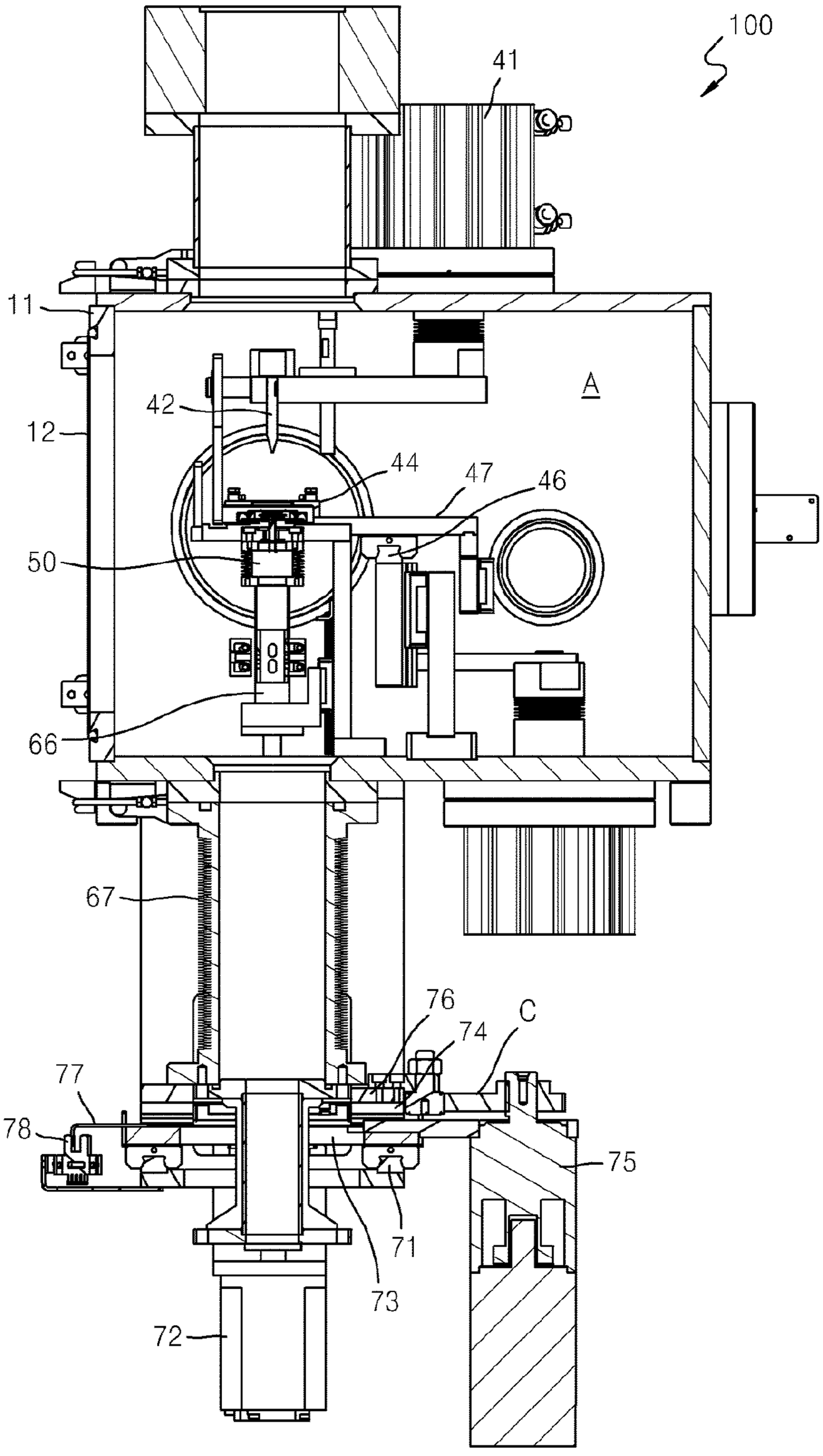
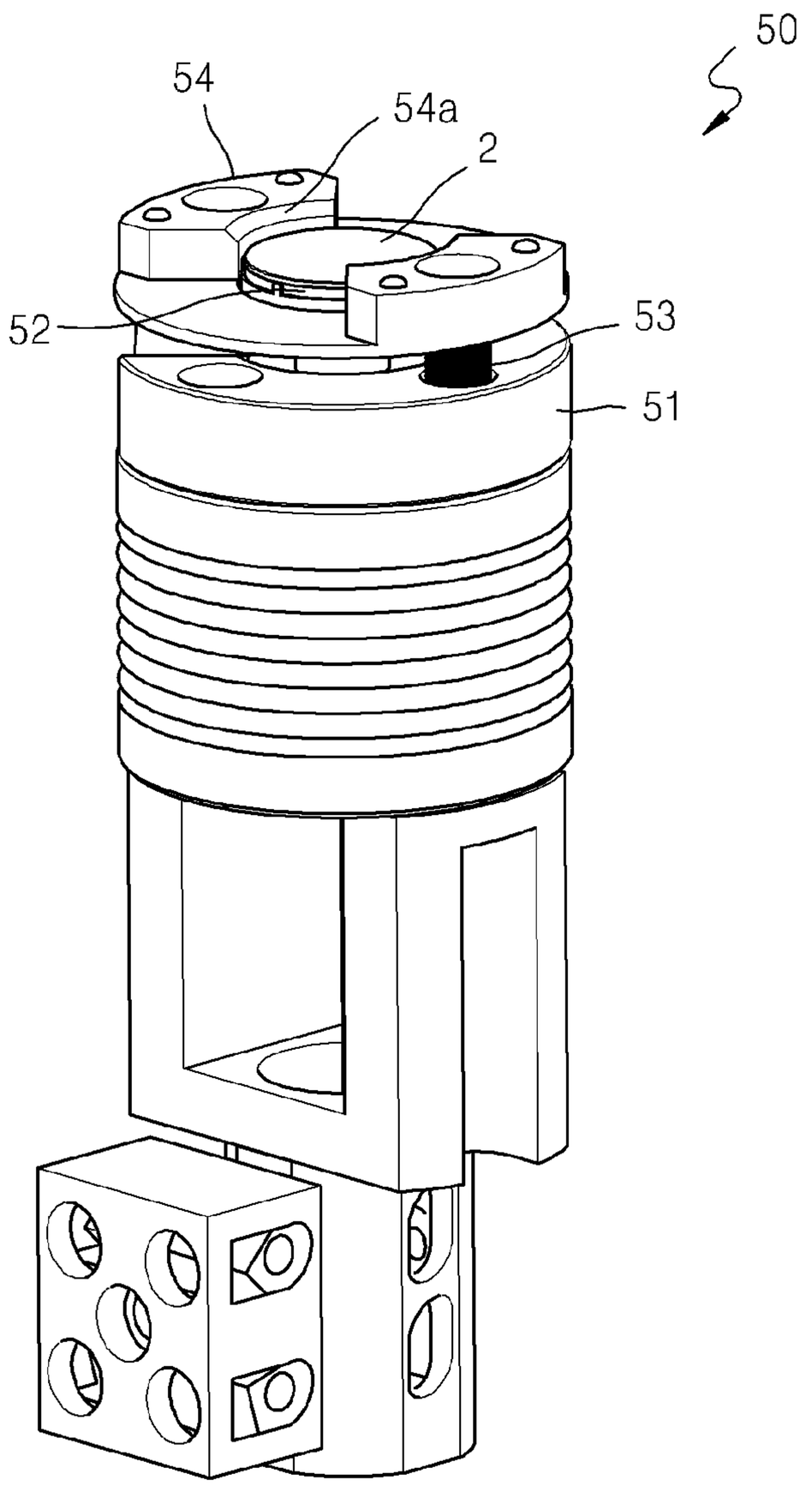
[Fig. 6]



[Fig. 7]



SEALING APPARATUS FOR VACUUM WINDOW MANUFACTURING EQUIPMENT

TECHNICAL FIELD

The present invention relates to a sealing apparatus for vacuum window manufacturing equipment, and more particularly, to a sealing apparatus for vacuum window manufacturing equipment, the sealing apparatus being configured to close a vacuum hole of a glass plate for a vacuum window with a cover.

BACKGROUND ART

In general, a vacuum window refers to a kind of glass window in which a vacuum is formed between upper and lower plates thereof for blocking noise and vibrations and improving thermal insulation by blocking thermal energy transferred from the outside.

In the related art, vacuum windows are manufactured by applying a frit (frit seal) to the edges of a glass plate including a pair of upper and lower plates, heat treating the glass plate, cooling the glass plate at room temperature, and creating a vacuum between the upper and lower plates.

Particularly, an exhaust hole is formed in the lower plate, and a tip in the form of a short pipe is attached to the exhaust hole. Then, a vacuum hose is connected to the tip, and air is discharged from between the upper and lower plates to create a vacuum. Thereafter, the vacuum hose is removed, and the tip is welded to seal the vacuum.

However, vacuum windows manufacturing according to the above-described method of the related art have many problems such as forming of vacuum windows having uneven surfaces due to tips fused to lower plates and protruding therefrom, low functionality caused by a low degree of vacuum created using the vacuum hose, product damage caused by protruding tips vulnerable to impacts.

Particularly, since pallets for transferring large vacuum windows under high-temperature, high-vacuum-degree conditions have not yet been developed for the vacuum window manufacturing method, a series of processes has to be manually performed. That is, process automation and automatic line production are impossible. As a result, productivity is very low.

DETAILED DESCRIPTION OF THE INVENTIVE CONCEPT

Technical Problem

The present invention provides a sealing apparatus for vacuum window manufacturing equipment, the sealing apparatus being configured to seal a vacuum hole of a glass plate for a vacuum window with a cover when the glass plate is transferred along an automatic manufacturing line, thereby facilitating process automation and improving productivity.

Technical Solution

According to an aspect of the present invention for solving the technical problem, there is provided a sealing apparatus for vacuum window manufacturing equipment, the sealing apparatus being configured to cover a vacuum hole formed in at least one glass plate for a vacuum window with a cover. The sealing apparatus may include: a vacuum chamber including an internal space and configured to be evacuated for forming a vacuum therein; a cartridge installed in the internal space and accommodating a plurality of covers; a cartridge elevator installed on the vacuum chamber and configured to sequentially lift or lower the cartridge; a cover transfer device installed in the internal space and configured to transfer the covers one by one from the cartridge; a cover-rest head configured to receive a cover from the cover transfer device; and a head elevator configured to lift up the cover-rest head to the vacuum hole of the glass plate.

In addition, according to the prevent invention, the vacuum chamber may include: a door on a side thereof; and a window configured to allow checking an inside state of the vacuum chamber.

In addition, according to the prevent invention, the cartridge elevator may include: a fixed frame fixed to the vacuum chamber; a screw rod installed on the fixed frame; a rotation motor configured to rotate the screw rod; a guide member installed on the fixed frame; a movable base into which the screw rod is inserted in a screw engagement manner so that the movable base is lifted or lowered along the guide member; an extension rod installed on the movable base and extending from the movable base to the cartridge; and a bellows tube installed between the movable base and the vacuum chamber and enclosing the extension rod.

In addition, according to the prevent invention, the cartridge elevator may further include a limit optical sensor installed on the fixed frame and configured to detect a detection protrusion on the movable base.

In addition, according to the prevent invention, the cover transfer device may include: elastic fingers configured to be selectively closed or opened by a first wedge member and a second wedge member lifted or lowered by a first cylinder; and a finger table on which the elastic fingers are installed, the finger table being configured to be moved by a second cylinder along a finger transfer rail installed in the vacuum chamber.

In addition, according to the prevent invention, the cover-rest head may include: a head body; a heater installed on the head body and configured to heat the cover; and an elastic guide connected to an elastic spring installed on the head body and configured to elastically move backward to a lower side of the cover when a force is applied thereto, the elastic guide including a guide groove to guide the cover.

In addition, according to the prevent invention, the head elevator may include: a fixed frame fixed to the vacuum chamber; a screw rod installed on the fixed frame; a rotation motor configured to rotate the screw rod; a guide member installed on the fixed frame; a movable base into which the screw rod is inserted in a screw engagement manner so that the movable base is lifted or lowered along the guide member; an extension rod installed on the movable base and extending from the movable base to the cover-rest head; and a bellows tube installed between the movable base and the vacuum chamber and enclosing the extension rod.

In addition, according to the prevent invention, the head elevator may further include a position adjustment device installed between the extension rod and the cover-rest head and configured to move the cover-rest head in x-axis and y-axis directions.

In addition, according to the prevent invention, the position adjustment device may include: a y-axis movable base configured to be moved in the y-axis direction by a y-axis transfer motor along a y-axis rail installed on the fixed frame; and an x-axis movable base configured to be moved in the x-axis direction by an x-axis transfer motor along an

x-axis rail installed on the y-axis movable base, the x-axis movable base being connected to the extension rod.

In addition, according to the prevent invention, the position adjustment device may further include a limit optical sensor installed on the fixed frame and configured to detect a detection protrusion on the y-axis movable base.

Advantageous Effects

According to the present invention, the sealing apparatus for vacuum window manufacturing equipment is provided to close and seal a vacuum hole of a glass plate for a vacuum window with a cover and to thus facilitate process automation and improve the productivity and precision of the vacuum window manufacturing equipment.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view illustrating a sealing apparatus for vacuum window manufacturing equipment according to some embodiments of the present invention.

FIG. **2** is an enlarged perspective view illustrating an assembled state of a vacuum chamber illustrated in FIG. **1**.

FIG. **3** is an enlarged perspective view illustrating a portion B of FIG. **1**.

FIG. **4** is an enlarged perspective view illustrating a portion C of FIG. **1**.

FIG. **5** is a front view illustrating the vacuum chamber illustrated in FIG. **2**.

FIG. **6** is a side sectional view illustrating the vacuum chamber illustrated in FIG. **2**.

FIG. **7** is a perspective view illustrating a cover-rest head illustrated in FIG. **1**.

BEST MODE

Exemplary embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

The present invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided to give a clear understanding of the present invention to those of ordinary skill in the art. That is, the embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the inventive concept to those of ordinary skill in the art. In the accompanying drawings, the thickness or size of each layer are exaggerated for illustrative purposes and clarity.

In the specification, when an element such as a film, a region, or a substrate is referred to as being "above," "on," "connected to,", "disposed on," or "coupled to" another element, it can be directly "above," "on," "connected to,", "disposed on," or "coupled to" the other element, or intervening elements may also be present. However, when an element is referred to as being "directly on or above," or "directly coupled to" another element, no intervening element is present. In the drawings, like reference numerals denote like elements. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that, although the terms first, second, etc. may be used herein to describe various members, components, regions, layers, and/or sections, these members, components, regions, layers, and/or sections should not be limited by these terms. These terms are only used to distinguish one member, component, region, layer or section from another member, component, region, layer, or section. Thus, a first member, component, region, layer, or section, discussed below could be termed a second member, component, region, layer, or section without departing from the teachings of the present invention.

Spatially relative terms, such as "on," "above," "upper," "beneath," "below," "lower," and the like, may be used herein to describe one element's relationship to another element(s) as illustrated in the drawings. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the drawings. For example, if the device in the drawings is turned over, elements described as "above" other elements would then be oriented "below" or "beneath" the other elements. Thus, the exemplary term "above" may encompass both orientations of above and below. The device may be otherwise oriented (rotated 90 degrees or in other orientations) and the spatially relative descriptors used herein interpreted accordingly.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated shapes, integers, steps, operations, members, elements, and/or groups thereof, but do not preclude the presence or addition of one or more other shapes, integers, steps, operations, members, elements, and/or groups thereof.

Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings in which ideal embodiments are illustrated. Shapes illustrated in the drawings may be varied according to various factors such as manufacturing methods and/or tolerances. That is, the embodiments of the present invention are not limited to particular shapes illustrated in the drawings. Factors such as shape changes in manufacturing processes should be considered.

FIG. **1** is an exploded perspective view illustrating a sealing apparatus **100** for vacuum window manufacturing equipment according to some embodiments of the present invention; FIG. **2** is an enlarged perspective view illustrating an assembled state of a vacuum chamber **10** illustrated in FIG. **1**; FIG. **3** is an enlarged perspective view illustrating a portion B of FIG. **1**; FIG. **4** is an enlarged perspective view illustrating a portion C of FIG. **1**; FIG. **5** is a front view illustrating the vacuum chamber **10** illustrated in FIG. **2**; and FIG. **6** is a side sectional view illustrating the vacuum chamber **10** illustrated in FIG. **2**.

First, according to some embodiments of the present invention illustrated in FIGS. **1** to **6**, the sealing apparatus **100** for vacuum window manufacturing equipment may be used to cover a vacuum hole **1***a* formed in at least one glass plate **1** for a vacuum window with a cover **2**. The sealing apparatus **100** may mainly include the vacuum chamber **10**, a cartridge **20**, a cartridge elevator **30**, a cover transfer device **40**, a cover-rest head **50**, and a head elevator **60**.

As shown in FIGS. **1** to **6**, the vacuum chamber **10** may be a chamber structure including an internal space A in which a vacuum can be formed.

A door **11** may be installed on a side of the vacuum chamber **10** as shown in FIGS. **1** to **6**, so as to supply or replace components through the door **11**. In addition, the

vacuum chamber **10** may include a window **12** so that workers may observe the inside of the vacuum chamber **10** with the naked eye.

The cartridge **20** may be a structure installed in the internal space A of the vacuum chamber **10** to accommodate a stack of covers **2**, and the cartridge **20** may be sequentially lifted or lowered by the cartridge elevator **30**.

The cartridge elevator **30** is connected to the vacuum chamber **10**. As shown in FIGS. **1** to **6**, so as to sequentially lift or lower the cartridge **20**, the cartridge elevator **30** may include: a fixed frame **31** fixed to the vacuum chamber **10**; a screw rod **32** installed on the fixed frame **31**; a rotation motor **33** configured to rotate the screw rod **32**; a guide member **34** installed on the fixed frame **31**; a movable base **35** into which the screw rod **32** is inserted in a screw engagement manner so as to lift or lower the movable base **35** along the guide member **34**; an extension rod **36** installed on the movable base **35** and extending from the movable base **35** to the cartridge **20**; and a bellows tube **37** installed between the movable base **35** and the vacuum chamber **10** and enclosing the extension rod **36**.

Therefore, the cartridge elevator **30** may operate as follows. If the rotation motor **33** is rotated by a predetermined amount per rotation, the screw rod **32** is rotated, and thus the movable base **35** is sequentially lifted along the guide member **34**. Then, the covers **2** stacked on the cartridge **20** are sequentially transferred by the cover transfer device **40** (described later). Therefore, although there is an empty space in the cartridge **20**, the cartridge **20** may sequentially provide the covers **2** so that the uppermost cover **2** may always be placed at a constant height.

In addition, as shown in FIG. **3**, the cartridge elevator **30** may further include limit optical sensors **38** attached to the fixed frame **31** to detect a detection protrusion **35***a* disposed on the movable base **35**.

Therefore, the uppermost position, the lowermost position, or an increased height of the cartridge **20** may be detected using the limit optical sensors **38** so as to help an operator to check operational states or inform the operator of a time point for adding new covers **2**.

In addition, as shown in FIGS. **1** to **6**, the cover transfer device **40** is installed in the internal space A to transfer the covers **2** one by one from the cartridge **20**. The cover transfer device **40** may include: an elastic fingers **44** configured to be selectively closed or opened by a first wedge member **42** and a second wedge member **43** vertically moved by a first cylinder **41**; and a finger table **47** on which the elastic fingers **44** are installed, the finger table **47** being configured to be moved by a second cylinder **45** along a finger transfer rail **46** installed in the vacuum chamber **10**.

Therefore, the cover transfer device **40** may operate as follows. If the covers **2** are lifted to a certain height by the cartridge elevator **30**, the elastic fingers **44** opened by the first wedge member **42** is closed to hold one of the covers **2** as the first wedge member **42** is lifted by the first cylinder **41**. Then, the elastic fingers **44** holding the cover **2** are moved together with the finger table **47** toward the cover-rest head **50** by using the second cylinder **45**. Thereafter, the second wedge member **43** is lowered to open the elastic fingers **44** and to thus place the cover **2** on the cover-rest head **50**.

That is, a driving mechanism such as a cylinder or a motor is not installed in the vacuum chamber **10** but is installed outside the vacuum chamber **10**. Therefore, the covers **2** may be kept clean and protected from foreign substances, and the vacuum chamber **10** may be maintained at a high degree of vacuum.

FIG. **7** is a perspective view illustrating the cover-rest head **50** illustrated in FIG. **1**.

Referring to FIG. **7**, the cover-rest head **50** configured to receive a cover **2** from the cover transfer device **40** may include a head body **51**; a heater **52** installed on the head body **51** to heat the cover **2**; and an elastic guide **54** connected to an elastic spring **53** installed on the head body **51** for being elastically moved backward to a lower side of the cover **2** when a force is applied to the elastic guide **54**, the elastic guide **54** including a guide groove **54***a* to guide the cover **2**.

Therefore, when the cover **2** is placed on the cover-rest head **50**, the cover **2** may be guided and aligned by the guide groove **54***a* of the elastic guide **54**, and the cover **2** placed on the cover-rest head **50** may be previously heated to a high temperature by the heater **52**. If the cover-rest head **50** on which the cover **2** is placed is lifted toward the glass plate **1** by the head elevator **60**, the elastic guide **54** is first brought into contact with the glass plate **1** and elastically moved backward, and then the cover **2** aligned by the guide groove **54***a* may be precisely placed on the vacuum hole H of the glass plate **1** for sealing the vacuum hole H.

The head elevator **60** is used to lift the cover-rest head **50** to the vacuum hole H of the glass plate **1**. To this end, as shown in FIGS. **1** to **6**, the head elevator **60** may include: a fixed frame **61** fixed to the vacuum chamber **10**; a screw rod **62** installed on the fixed frame **61**, a rotation motor **63** configured to rotate the screw rod **62**; a guide member **64** installed on the fixed frame **61**; a movable base **65** into which the screw rod **62** is inserted in a screw engagement manner so as to lift or lower the movable base **65** along the guide member **64**; an extension rod **66** installed on the movable base **65** and extending from the movable base **65** to the cover-rest head **50**; and a bellows tube **67** installed between the movable base **65** and the vacuum chamber **10** and enclosing the extension rod **66**.

Therefore, the head elevator **60** may operate as follows. If the rotation motor **63** is rotated, the screw rod **62** is rotated, and thus the movable base **65** is lifted along the guide member **64** so that the cover-rest head **50** on which the cover **2** is placed may be lifted toward the glass plate **1**. Next, if the cover **2** is placed on the glass plate **1** for sealing the glass plate **1**, the rotation motor **63** may be rotated in the reverse direction to lower the movable base **65** for the next cover **2**.

In addition, as shown in FIGS. **1** to **6**, according to the embodiments of the present invention, the sealing apparatus **100** for vacuum window manufacturing equipment may further include a position adjustment device **70** installed between the extension rod **66** and the cover-rest head **50** and configured to move the cover-rest head **50** in x-axis and y-axis directions.

As shown in FIGS. **1** to **6**, the position adjustment device **70** may include: a y-axis movable base **73** configured to be moved in the y-axis direction along a y-axis rail **71** installed on the fixed frame **61** by a y-axis transfer motor **72** rotating a cam C; and an x-axis movable base **76** configured to be moved in the x-axis direction by an x-axis transfer motor **75** along an x-axis rail **74** installed on the y-axis movable base **73**, the x-axis movable base **76** being connected to the extension rod **66**.

Therefore, the cover-rest head **50** connected to the extension rod **66** may be precisely moved in the x-axis and y-axis directions by properly rotating the x-axis transfer motor **75** and the y-axis transfer motor **72**, so as to exactly align the cover-rest head **50** with the vacuum hole H of the glass plate **1**.

In addition, as shown in FIG. **4**, the position adjustment device **70** may include limit optical sensors **78** attached to the fixed frame **61** to detect a detection protrusion **77** disposed on the y-axis movable base **73**.

Therefore, the position of the cover-rest head **50** connected to the extension rod **66** may be detected using the limit optical sensors **78** to help an operator to precisely adjust the cover-rest head **50**.

INDUSTRIAL APPLICABILITY

The present invention is not limited to the above-described embodiments, and it will be understood by those skilled in the art that various changes in form and details may be made in the embodiments without departing from the scope of the invention.

Therefore, the scope of the invention is not limited to the descriptions of the embodiments but is defined by the following claims.

The invention claimed is:

1. A sealing apparatus for vacuum window manufacturing equipment, the sealing apparatus being configured to cover a vacuum hole formed in at least one glass plate for a vacuum window with a cover, the sealing apparatus comprising:

a vacuum chamber comprising an internal space and configured to be evacuated for forming a vacuum therein;

a cartridge installed in the internal space and accommodating a plurality of covers;

a cartridge elevator installed on the vacuum chamber and configured to sequentially lift or lower the cartridge;

a cover transfer device installed in the internal space and configured to transfer the covers one by one from the cartridge;

a cover-rest head configured to receive a cover from the cover transfer device; and

a head elevator configured to lift up the cover-rest head to the vacuum hole of the glass plate.

2. The sealing apparatus of claim **1**, wherein the vacuum chamber comprises:

a door on a side thereof; and

a window configured to allow checking an inside state of the vacuum chamber.

3. The sealing apparatus of claim **1**, wherein the cartridge elevator comprises:

a fixed frame fixed to the vacuum chamber;

a screw rod installed on the fixed frame;

a rotation motor configured to rotate the screw rod;

a guide member installed on the fixed frame;

a movable base into which the screw rod is inserted in a screw engagement manner so that the movable base is lifted or lowered along the guide member;

an extension rod installed on the movable base and extending from the movable base to the cartridge; and

a bellows tube installed between the movable base and the vacuum chamber and enclosing the extension rod.

4. The sealing apparatus of claim **1**, wherein the cartridge elevator further comprises a limit optical sensor installed on the fixed frame and configured to detect a detection protrusion on the movable base.

5. The sealing apparatus of claim **1**, wherein the cover transfer device comprises:

elastic fingers configured to be selectively closed or opened by a first wedge member and a second wedge member lifted or lowered by a first cylinder; and

a finger table on which the elastic fingers are installed, the finger table being configured to be moved by a second cylinder along a finger transfer rail installed in the vacuum chamber.

6. The sealing apparatus of claim **1**, wherein the cover-rest head comprises:

a head body;

a heater installed on the head body and configured to heat the cover; and

an elastic guide connected to an elastic spring installed on the head body and configured to elastically move backward to a lower side of the cover when a force is applied thereto, the elastic guide comprising a guide groove to guide the cover.

7. The sealing apparatus of claim **1**, wherein the head elevator comprises:

a fixed frame fixed to the vacuum chamber;

a screw rod installed on the fixed frame;

a rotation motor configured to rotate the screw rod;

a guide member installed on the fixed frame;

a movable base into which the screw rod is inserted in a screw engagement manner so that the movable base is lifted or lowered along the guide member;

an extension rod installed on the movable base and extending from the movable base to the cover-rest head; and

a bellows tube installed between the movable base and the vacuum chamber and enclosing the extension rod.

8. The sealing apparatus of claim **7**, wherein the head elevator further comprises a position adjustment device installed between the extension rod and the cover-rest head and configured to move the cover-rest head in x-axis and y-axis directions.

9. The sealing apparatus of claim **8**, wherein the position adjustment device comprises:

a y-axis movable base configured to be moved in the y-axis direction by a y-axis transfer motor along a y-axis rail installed on the fixed frame; and

an x-axis movable base configured to be moved in the x-axis direction by an x-axis transfer motor along an x-axis rail installed on the y-axis movable base, the x-axis movable base being connected to the extension rod.

10. The sealing apparatus of claim **9**, wherein the position adjustment device further comprises a limit optical sensor installed on the fixed frame and configured to detect a detection protrusion on the y-axis movable base.

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